

176587

**Comments on Work Plan for DNAPL Characterization and Remediation Study,
Sauget Area 1, Sauget, Illinois dated February 28, 2003.**

Comments prepared by Laramide Environmental, LLC March 25, 2003.

1. *Page 1, Introduction:* Several focus areas from the USEPA's January 9, 2003 letter to Solutia are listed on Page 1 of the work plan, including:

- The characterization and distribution of DNAPL within the middle and deep hydrogeologic units, the assessment of DNAPL migration under current and future site conditions, and the risk of uncontrolled DNAPL mobilization.
- The extent and properties of DNAPL (e.g., density, viscosity, and interfacial tension); as well as the timing of the DNAPL release; topography, property, and heterogeneity of geologic units on which the DNAPL may accumulate; the existence of ongoing DNAPL releases; and the transport characteristics of the bedrock.
- The evaluation of the DNAPL remedial options and the evaluation of the benefits and costs associated with source removal technologies (thermal technologies such as steam injection and chemically-enhanced extraction such as the use of surfactants or co-solvents).

Tasks described in the work plan only address a subset of these focus areas. With only three borings in Sites G, H, and I, the proposed work does not adequately assess the lateral and vertical distribution of DNAPLs beneath the source areas in Sauget Area 1. No attempt is to be made to assess the timing of DNAPL releases; the topography, physical properties, and heterogeneities of the geologic units; the potential existence of ongoing DNAPL releases; or the field-scale transport characteristics of the bedrock. All focus areas should be addressed to meet the objectives of the investigation without the need for multiple mobilizations to correct deficiencies after the fact.

2. *Page 1, Introduction:* The text states that Site L was used as a tank truck washout lagoon, and proposes to not include Site L in the investigation due to this site history. The tank trucks that were cleaned in Site L included trucks from hazardous-waste transporters. The test trenching conducted during the EE/CA investigation revealed the presence of drums and drum debris in Site L, including drums that were observed to be leaking liquid products. Given the historical operations and results of previous investigations, Site L should be included in the investigation of the nature and extent of DNAPLs in the subsurface of Area 1.
3. *Page 3, Task 2, Initial DNAPL Survey:* No DNAPL sample collection is proposed during the initial DNAPL survey in existing wells. Samples of DNAPL should be collected if encountered during the initial survey. These samples, or at least a representative subset, should be analyzed for chemical composition and physical-chemical characteristics. It is likely given the observations during the

EE/CA investigation and the history of Sites G, H, I, and L that several different DNAPLs will be encountered at Area 1.

4. *Page 3, Task 2, Initial DNAPL Survey:* Only one location in each of three fill areas, based on the existing well with the maximum measured DNAPL thickness, is proposed for sampling and piezometer installation. This does not adequately characterize the lateral extent of DNAPL contamination in the aquifer materials. Locations should be selected to provide a valid and scientifically defensible assessment of the extent of DNAPLs beneath Sites G, H, I, and L. It is possible that the presence of DNAPLs is confined to aquifer materials in discrete zones beneath the fill areas, which would dramatically reduce the estimated cost of DNAPL remediation while increasing the likelihood of a successful source reduction effort. Additional locations are also necessary to evaluate the topography of the bedrock surface, which is a focus area described in the USEPA letter and may control DNAPL presence and pooling at the bottom of the unconsolidated alluvial aquifer.
5. *Page 3, Task 3, Soil Sampling and Installation of Piezometers:* Continuous coring using a sonic drilling technique is a good choice of investigative method, assuming the sonic rig can penetrate the bedrock interface. As discussed in comment 4 above, the number of locations is not adequate to achieve the project objective of characterizing the spatial extent of DNAPL contamination.

Partitioning Interwell Tracer Tests should be considered to evaluate the distribution of DNAPLs in the aquifer materials that are in direct contact with flowing groundwater. These tests, properly performed, can provide good data regarding the distribution and availability of DNAPLs at a field scale approaching the scale of concern for aquifer remediation.

6. *Page 3, Task 3, Soil Core Examination:* Field screening using a technique such as ultraviolet fluorescence would be appropriate to more positively identify zones that contain DNAPLs, and to be more confident in the identification of aquifer zones that do not contain DNAPLs. Limiting the field screening to visual examination and PID measurements reduces the confidence that DNAPLs of low volatility will be identified. Soils should be classified by texture using an accepted standard method such as the Unified Soil Classification System or appropriate ASTM standards.
7. *Page 4, Task 3, Analytical Program for Soil Samples:* In addition to the chemical analyses, soil samples should be evaluated for physical characteristics including bulk density, total porosity, grain-size distribution, and fraction organic carbon. These are critical parameters for the evaluation of DNAPL mass and mobility and are relatively inexpensive tests. There is no reason to rely on estimated values as suggested in the text when the samples are already being collected. The 4-inch core size should provide the relatively undisturbed samples that are needed for porosity and bulk density measurements.

The number of samples to be submitted to PTS Laboratories should be identified. The specific tests and modifications to be used by PTS should also be described. The referenced API RP-40 document includes a wide variety of analytical methods.

8. *Page 4, Task 3, Installation and Development of Piezometers:* The size of the screen

slots and sand pack should be selected based on the grain-size distribution of the aquifer materials at the well location.

9. *Page 5, Task 4, DNAPL Mobility Evaluation:* DNAPL mobility should be evaluated for the major lithologies encountered in the unconsolidated aquifer. Differences in DNAPL mobility between the shallow, middle, and deep hydrogeologic units may provide important controls on the pattern of DNAPL migration and eventual remediation.

If the cores collected using the sonic drilling method are not suitable for DNAPL mobility testing, it is unlikely that Geoprobe samples will provide adequate replacements. Typical Geoprobe equipment is relatively small-diameter (2 inches or less), which would prevent the collection of undisturbed samples. Drilling a borehole to the desired depth, then pushing a thin-walled (Shelby tube) sampler through the bit to collect a sample would be more appropriate in this case. Geoprobe rigs may also have difficulty advancing a probe to the deeper portions of the unconsolidated aquifer.

10. *Page 5, Task 4, DNAPL Recovery Tests:* The proposed tests would only evaluate DNAPL recovery from the alluvial aquifer/bedrock interface. DNAPL recovery tests should also be performed in the existing wells with significant DNAPL thicknesses. This will provide a better assessment of DNAPL recovery throughout the aquifer; will provide additional DNAPL volume for further analyses; and will provide an assessment of the variation in DNAPL characteristics encountered throughout Sites G, H, I, and L.

The volume of DNAPL required for the physical and chemical analyses to be conducted by PTS Laboratories should be evaluated and described in the work plan. This will avoid the problems encountered during the EE/CA and RI/FS investigation when inadequate sample volume and inappropriate containers were used to collect samples for treatability analyses.

11. *Page 7, Task 6, Review of DNAPL Source Depletion Alternatives:* Limiting the evaluation to a Remediation Performance Database that is not yet complete is not necessary. Sources such as the USEPA Technology Innovation Office's Cleanup and Information System (<http://www.clu-in.org>), the Groundwater Remediation Technologies Analysis Center (<http://www.gwrtac.org>), and other readily available sources of information should also be consulted.

April 18, 2003

MEMORANDUM

SUBJECT: Sauget Area 1 Superfund Site, Sauget, IL (02-R05-001)
Workplan for DNAPL Characterization and Remediation Study

FROM: Steven D. Acree, Hydrogeologist
Applied Research and Technical Support Branch

TO: Nabil Fayoumi, RPM
U.S. EPA, Region 5

As requested, the referenced document has been reviewed under the direction of James W. Mercer, Ph.D., P.G., of Geotrans Inc., through Dynamac Corporation. Dynamac Corporation is an off-site contractor providing technical support services to this laboratory. In general, the workplan is responsive to the request for additional characterization of DNAPL and the potential types of remedial options that may be appropriate at Area 1. The following comments and recommendations are intended to enhance the investigation.

General Comments

1. Based on the DNAPL thickness data provided in Table 4-0c and locations of monitoring wells/piezometers in Figure 4-37 of the EE/CA for Area 1, DNAPL is found beyond Sites G, H, and I, including as far south as P3-A-S and P3-B-S. For this reason, it is not clear why only Sites G, H, and I are considered for the DNAPL study. In order to determine the extent of DNAPL, the study needs to extend beyond these three Sites. It would be helpful to provide a plot of the DNAPL thickness data in Table 4-0c showing the various Sites and all monitoring wells/piezometers. This figure could be used to show the proposed locations of soil borings/monitoring wells.
2. Existing soil boring data should be used to construct structural maps on low-permeability layers and an alluvial aquifer/bedrock contact map showing the top of bedrock topography. Depending on the level of detail and confidence in these maps, it may be necessary for the Workplan to consider the use of surface geophysics (e.g., seismic reflection) to more accurately map units, especially the top of bedrock topography. This can be used to help identify stratigraphic traps for potential monitoring well locations.

Specific Comments

Task 2

3. The proposed survey for DNAPL in approximately 35 existing monitoring wells in Task 2 should be expanded to include all piezometers and wells in the potential DNAPL area. The survey should include monitoring at perimeter wells where DNAPL is not present to help bound the separate phase contamination. Monitoring at perimeter wells (where NAPL is not expected) should precede work in the 'dirty' area, with care taken to prevent cross-contamination. The results of the survey can then be compared to the results shown in Table 4-0c, which shows 33 monitoring wells/piezometers containing DNAPL (with a maximum DNAPL thickness of 23.29 feet at EE-01 within Site H). In addition, methods proposed for fluid thickness and interface measurement (interface probe, cotton string, and bailer) are appropriate, but protocols should be developed for cleaning the interface probe and possibly restricting the use of a 'clean' interface probe to 'clean' wells and a 'dirty' interface probe to 'dirty' wells.

4. Samples of NAPL retrieved using a bailer from each well during Task 2 should be tested, at a minimum, for viscosity and density (at known temperature). Simple methods (e.g., viscosity cup or viscometer for viscosity and hydrometer for density) are available to make these measurements. Qualitative observations of NAPL wettability (e.g., by checking spreading of NAPL injected using a pipette on alluvium, bedrock, and glass in a water-filled glass beaker) can also be made and documented by taking photographs and notes. Making measurements of NAPL properties at many locations will provide insight to the distribution of immiscible fluid at the site.

Task 3

5. The plan proposes to install only three new boring/piezometers. Based on the table of wells/piezometers containing DNAPL, DNAPL appeared to be more wide spread than indicated by this proposal. Plots of DNAPL and top of bedrock are needed to see where new wells should be placed. These plots will help determine in which directions we know the extent of DNAPL and those directions where we do not know the extent. Using this lack of DNAPL definition as well as knowledge of the top of bedrock (indicating potential DNAPL flow directions), new wells can then be located and drilled. Using this knowledge regarding the lack of DNAPL definition in specific areas as well as knowledge of the top of bedrock (indicating potential DNAPL flow directions), new wells can then be located and drilled. The number of wells depends on what these maps show. It is recommended that this information be provided to support the decision concerning the appropriate number of borings/piezometers.

6. Soil sample collection should be performed using methanol as a preservative (i.e., EPA SW846 Method 5035).

7. Depending on integrity of the bedrock (fractures, etc.) and whether the bedrock contains DNAPL, it may be necessary to perform further characterization of the bedrock. The EE/CA, RI/FS report indicates that DNAPL has accumulated at the alluvium/bedrock interface. The

carbonate bedrock is assumed to be fractured in a heterogeneous manner. It is considered highly likely that DNAPL and dissolved contaminants have migrated into the rock. It is suggested that the presence of DNAPL in bedrock below the alluvium/bedrock interface should be evaluated, in part, by examining contaminant concentrations in groundwater sampled at downgradient locations (thought to be beyond the DNAPL zone.) Some discussion/analysis should be presented to explain groundwater flow patterns and rates between the site and the Mississippi River, including flow between the alluvium and rock.

8. Consideration should be given to placing a hydrophobic dye-striped NAPL FLUTE strip between the Rotasonic soil core and the plastic core sleeve to help identify NAPL presence as described by Griffin and Watson (2002, Ground Water Monitoring & Remediation 22(2):48-59).

9. It is suggested that representative samples of core also be analyzed to determine formation porosity and fraction organic carbon rather than using assumed values in the proposed calculations. These data are relatively inexpensive to acquire and will better support calculations of DNAPL saturation using a program such as NAPLANAL (available at www.dnapl.com/publications.html).

Task 4

10. Given the thickness of DNAPL that accumulates in existing wells, it would appear that DNAPL recovery tests could also be performed on select existing wells. Consideration should be given to using alternative methods of pumping (e.g. inertial lift) in which only disposable components are placed downhole.

Task 5

11. It is recommended that measurements be made to determine the relationship between surfactant concentration and NAPL-water interfacial tension as part of the surfactant treatability test.

If you have any questions concerning this evaluation, please do not hesitate to call me at your convenience (580-436-8609). We look forward to future interactions with you concerning this and other sites.

cc: Rich Steimle (5102G)
Larry Zaragoza (5204G)
Luanne Vanderpool, Region 5
Doug Yeskis, Region 5